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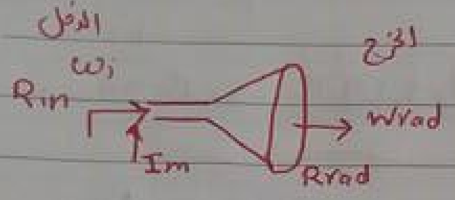
lec

input resistance



$W_i > W_{rad}$ in general

for loss antenna

$W_i = W_{rad}$

$$\frac{I_m^2 R_i}{2} = \frac{I_m^2}{2} R_{rad}$$

$$\boxed{R_i = R_{rad}}$$

for dipole $R_{in} = R_{rad} = 73\,\Omega$

for Mono Pole $\Rightarrow R_{in_{mono}} = \frac{R_{in}}{2} = 36.5\,\Omega$

* effective area

dipole $G = kD$

$$\boxed{G = \frac{4\pi}{\lambda^2} A_{eff}}$$

$$A_{eff} = \frac{G}{4\pi}\lambda^2$$

$G = 1.64 \cdot K$

for lossless Antenna

$$\boxed{K = 1}$$

$$A_{eff} = \frac{1.64}{4\pi}\lambda^2 \Rightarrow \boxed{A_{eff} = 0.13\,\lambda^2}$$

effective area

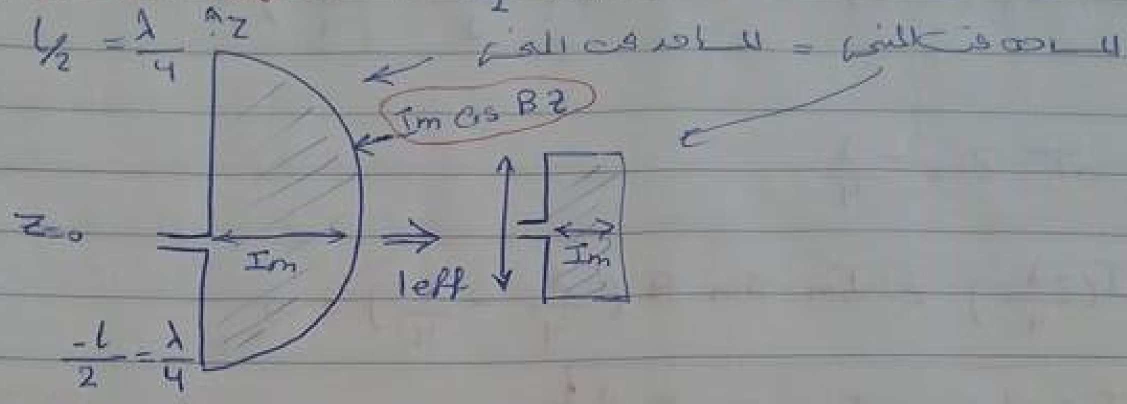
Mono Pole

$$A_{eff_{mono}} = \frac{G_{mono}}{4\pi}\lambda^2$$

$$= \frac{3.68}{4\pi}\lambda^2 = 0.26\,\lambda^2$$

سؤال

Affective length for $\frac{\lambda}{2}$ dipole



$$I(z) = \begin{cases} I_m \sin B\left(\frac{l}{2} - z\right) & z = 0 \\ I_m \sin B\left(\frac{l}{2} + z\right) & z < 0 \end{cases}$$

$$I_m \, l_{eff} = \int_{-\lambda/4}^{\lambda/4} I(z')\, dz'$$

At $z = 0$

$$I(0) = I_m \sin B\left(\frac{l}{2}\right) = I_m \sin\left(\frac{2\pi}{\lambda} \cdot \frac{1}{2} \cdot \frac{\lambda}{2}\right)$$

$$= I_m \sin\left(\frac{\pi}{2}\right) = I_m$$

$$\Rightarrow I(z) = I_m \cos B \overset{0}{\cancel{z}} = I_m$$

At $z = \frac{\lambda}{4}$

$$I\left(\frac{\lambda}{4}\right) = I_m \sin B\left(\frac{\lambda}{4} - \frac{\lambda}{4}\right) = I_m \sin(0) = 0$$

$$I_m \cos(\beta z) = I_m \cos\left(\frac{2\pi}{\lambda}\cdot\frac{\lambda}{4}\right) = I_m \cos\frac{\pi}{2} = 0$$

* at $z = \frac{-\lambda}{4}$

$$I\left(\frac{-\lambda}{4}\right) = I_m \sin \beta\left(\frac{\lambda}{4} - \frac{\lambda}{4}\right) = 0$$

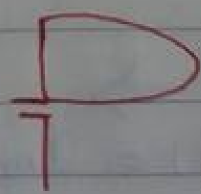
$$\boxed{I(z') = I_m \cos \beta z'}$$

So
$$\cancel{I_m}\, l_{eff} = \int_{-\lambda/4}^{\lambda/4} \cancel{I_m} \cos \beta z' \, dz'$$

$$l_{eff} = \left[\frac{\sin \beta z'}{\beta}\right]_{-\lambda/4}^{\lambda/4} = \frac{1}{\beta}\left[\sin \overbrace{\frac{2\pi}{\lambda}}^{\beta} \cdot \frac{\lambda}{4}\right] - \left[\sin \frac{2\pi}{\lambda} \cdot \frac{-\lambda}{4}\right]$$

$$= \frac{\lambda}{2\pi} * \cancel{2}\, \underbrace{\sin\left(\frac{\pi}{2}\right)}_{1} = \boxed{\frac{\lambda}{\pi}}$$

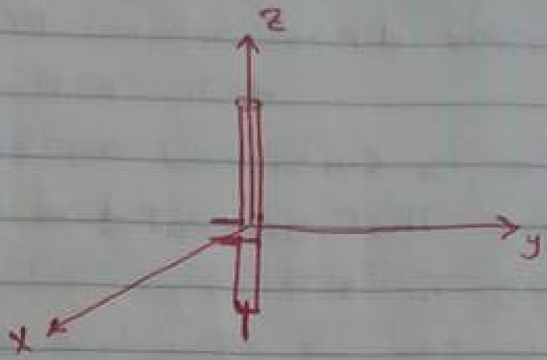
$$\boxed{l_{eff} = \frac{\lambda}{\pi}}$$ Dipole



For Mono Pole

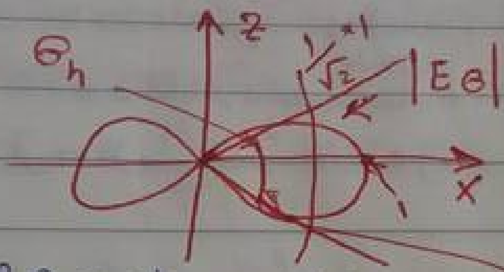
$$\boxed{l_{eff\,mono} = \frac{\lambda}{2\pi}}$$

* Field Pattern



E-Plane :→

(x-z) or (y,z)



$$|E\theta| = \left| \frac{\cos\left(\frac{\pi}{2}\cos\theta\right)}{\sin} \right|$$

كل ما طول الـ antenna تزيد

الـ Power تزيد و الـ Gain تزيد

Half Power Beam Width

$$\boxed{H.P.B.W = 78^\circ} = \Delta_3 dB =$$

تقل HPB

$$\frac{\cos\left(\frac{\pi}{2}\cos\theta_h\right)}{\sin\theta_h} = \frac{1}{\sqrt{2}} * 1$$

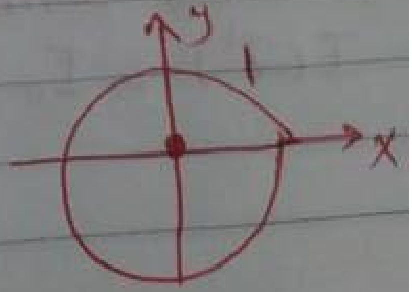
$$\boxed{\theta_h = 39^\circ}$$

$$\boxed{\Delta N.N = 180^\circ} \ \#$$

* H-Plane : (x-y) Plane

$$\theta = 90^\circ$$

$$|E\theta| = \left| \frac{\cos\left(\frac{\pi}{2}\cos 90^\circ\right)}{\sin 90} \right| = 1$$



نوع جديد من انواع ال antenna

* Travelling wave antenna : (TWA)
is used to overcome dipole antenna problem

* علشان نحل مشكلة ال dipole

* Dipole antenna :⇒ is considered as open ends transmission line that generates a standing wave pattern along the antenna.

اي سيركت على ال antenna wave بتاعه gain اقل

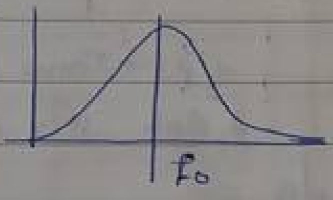
* اي حاجه بتكون ال Travelling ال gain بتاعها كبير

* standing wave ال gain بتاعها اقل

اي حاجه بتكون standing wave هتشتغل بالموديل بتاع ال antenna

هتكون عبارة عن resonance سيركت ولو معرفتش

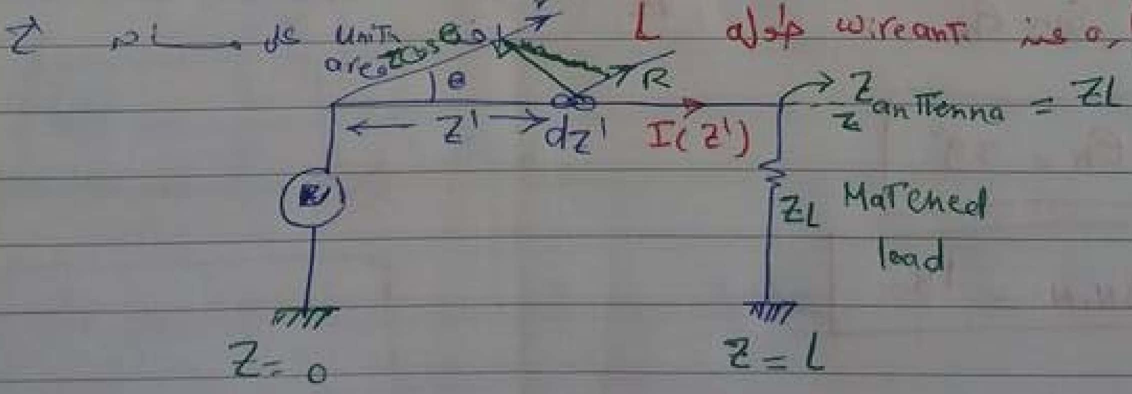
تردد الريزونانس هيحصل drop



اي حاجة

TWA ⇒ is a long wire terminated by a matched load

كابل مده طوله L wire anti



The current distribution is given by

$$I(z') = I_0 e^{-j\beta z'}$$

الصورة العامل لدى Propagate wave

$$W = W_0 \, e^{-JBZ} \quad e^{JWT}$$

تغير في الزمن

تغير في phase مع المسافة

* $B \Rightarrow$ Phase Constant

$Z' \Rightarrow$ distance

for far field approximation *

① $\frac{1}{R} \simeq \frac{1}{r}$ في حالة اقامة عمود

② $R = r - Z' \cos\theta$

determine The Magnetic Potential vector A_Z

القانون العام

~~Find Magnetic~~

$$A_Z = \frac{\mu}{4\pi} \int_0^L I(Z') \frac{e^{-JBR}}{R} \, dZ'$$

$$A_Z = \frac{\mu}{4\pi} \int_0^L I_0 \, e^{-JBZ'} \frac{e^{-JBR}}{R} \, dZ'$$

$$A_Z = \frac{\mu I_0}{4\pi} \int_0^L e^{-JBZ'} \frac{e^{-JB(r - Z'\cos\theta)}}{r} \, dZ'$$

$$= \frac{\mu I_0}{4\pi} \frac{e^{-JBr}}{r} \int_0^L e^{-JBZ'(1-\cos\theta)} \, dZ'$$

$$= \frac{\mu I_0}{4\pi} \frac{e^{-JBr}}{r} \left[\frac{e^{-JB(1-\cos\theta)Z'}}{-JB(1-\cos\theta)} \right]_0^L$$

$$\boxed{A_z = \frac{J \mu I_o}{4\pi} \frac{e^{-J\beta r}}{r} \frac{1}{\beta(1-\cos\theta)} \left[e^{-J\beta(1-\cos\theta)L} - 1 \right]}$$

$$E_\theta = J\omega A_z \sin\theta$$

$$E_\theta = \frac{-\omega \mu I_o}{4\pi} \frac{e^{-J\beta r}}{r} \frac{\sin\theta}{\beta(1-\cos\theta)} \left[e^{-J\beta(1-\cos\theta)L} - 1 \right]$$

$$E_\theta = \frac{\omega \mu I_o}{4\pi} \frac{e^{-J\beta r}}{r} \frac{\sin\theta}{\beta(1-\cos\theta)} \left[1 - e^{-J\beta(1-\cos\theta)L} \right]$$